DEC STD 102-3 Physical Stability Requirements During Shipping and Handling

DOCUMENT IDENTIFIER: A-DS-EL00102-03-0 Rev D1 22-Nov-1989

ABSTRACT: This standard sets forth the physical stability requirements for Digital products that are designed to be free standing when installed. Two product states are considered, the product as installed and the product as shipped.

APPLICABILITY: This standard specifies physical stability requirements for all free-standing Digital hardware products, including products housed in an individual cabinet, pedestal, or similar enclosure devices.

STATUS: APPROVED 22-Nov-1989; use VTX SMC for current status.

This document is confidential and proprietary. It is an unpublished work protected under the Federal copyright laws.

© Digital Equipment Corporation. 1989. All rights reserved.

TITLE: DEC STD 102-3 Physical Stability Requirements During Shipping and Handling

DOCUMENT IDENTIFIER: A-DS-EL00102-03-0 Rev D1, 22-Nov-1989

REVISION HISTORY:	Rev D,	18-Mar-1982	
	Rev D1,	22-Nov-1989	ECO Number CTS01
Document Management Category:	Product Environmental Requirements (HRE)		
Responsible Department:	Mechanical Technology Development Group		
Responsible Person:	Frank Grimaldi		

APPROVAL: This standard has been reviewed and recommended for approval by the General Review Group for its category. Rev D1 incorporates clerial changes only.

Frank Grimaldi, Mechanical Technology Development Group

Eric Williams, Standards Process Manager

Direct requests for further information to:

Frank Grimaldi

MLO6-2/T13, DTN: 223-4177, EUCLID::GRIMALDI

Use VTX SMC to order copies of this document from Standards and Methods Control.
Send distribution questions to JOKUR::SMC or call DTN: 287-3724.

CONTENTS

1 INTRODUCTION 1
1.1 PURPOSE 1
1.2 SCOPE 1
1.3 RESPONSIBILITIES 1
1.3.1 Design Engineer 1

2 GENERAL CONDITIONS 1
2.1 NORMAL CONDITIONS OF STABILITY 1
2.2 STATIC AND DYNAMIC STABILITY 2

3 STABILITY REQUIREMENTS - FREE STANDING PRODUCTS 2
3.1 STABILITY IN DIRECTION OF TRAVEL 3
3.2 STABILITY IN ANY OTHER DIRECTION 3
3.3 NON-COMPLIANT PRODUCTS 3

4 STABILITY REQUIREMENTS - PRODUCT AS SHIPPED 3
4.1 PRODUCTS SHIPPED/HANDLED WITHOUT SHIPPING SKIDS 4
4.1.1 Stability in Direction of Travel 4
4.1.1.1 Acceptable Waiver Alternative 4
4.1.2 Stability in Any Other Direction 4
4.1.2.1 Acceptable Waiver Alternative 4
4.1.3 Non-Compliant Products 4
4.2 PRODUCTS SHIPPED/HANDLED WITH SHIPPING SKIDS 4
4.2.1 Stability in Each Direction 4
4.2.1.1 Acceptable Waiver Alternative 4
4.2.2 Non-Compliant Products 5

5 MEASUREMENT OF STABILITY 5
5.1 MEASUREMENT OF STATIC STABILITY ANGLE 5
5.2 GO/NO GO STABILITY ASSESSMENT 5

Appendix A REFERENCED DOCUMENTS 7

A.1 EL-Class Digital Documents 7

TABLES

1 Physical Stability Requirements 6

1 INTRODUCTION

This standard sets forth the physical stability requirements for Digital products during or after shipping and installation at a customer site. It differs in content, purpose, and scope from physical stability requirements identified in *DEC STD 119-1 Digital Product Safety Design Criteria.* Physical stability criteria of both DEC STD 119 and DEC STD 102 are required for all Digital products.

1.1 PURPOSE

This section of DEC STD 102 describes the physical stability requirements that any free-standing Digital product must satisfy to ensure that the unit will not readily overturn during shipping, installation, or any subsequent movement. These requirements extend to any configuration of Digital products in any individual cabinet, enclosure, or pedestal.

1.2 SCOPE

These requirements apply to all free-standing products. For the purpose of this standard, the term product shall include configurations of products that are housed in an individual cabinet, pedestal, or similar enclosure devices. These requirements apply even if the products are intended to be fastened to structures or to other cabinets at the installation site.

DEC STD 102 physical stability requirements are specified, and are to be verified, according to two product states:

1. Product free-standing (refer to subhead 3).
2. Product as shipped (refer to subhead 4).

1.3 RESPONSIBILITIES

1.3.1 Design Engineer

It is the responsibility of the Design Engineer to assure that the product meets the requirements of this standard.

2 GENERAL CONDITIONS

2.1 NORMAL CONDITIONS OF STABILITY

Physical stability requirements set forth in this standard address occurrances to be expected in normal handling, shipping, and installation of a Digital product (as defined in subhead 1.2). Two product states are specified, the product free-standing and the product as shipped. In the as-shipped state, the product is considered for both skidded and unskidded delivery.

In both states, the product cabinet is assumed to incorporate casters or similar devices that facilitate movement. Because the casters can be fixed, locked, or free to swivel, stability requirements will differ according to whether the equipment is free to move in certain directions.

If all casters on the equipment are permitted to swivel, according to product specifications or shipping/handling procedures, the specified stability criteria apply to the four nominal directions of travel (front, back, left, and right). If the product specifications or shipping/handling procedures require two casters to be locked (preventing swivel), then the criteria apply to the resulting two nominal directions of travel (for example, left and right).

2.2 STATIC AND DYNAMIC STABILITY

The static stability criteria defined for direction of travel are based on dynamic stability requirements that minimize the possibility of equipment becoming unstable during necessary movement in manufacture, shipping, and handling. These criteria account for certain dynamic occurrances that might happen during normal equipment movement, such as when casters hit minor obstructions or irregular surfaces at reasonable movement velocities (2.5 mph, 3.7 fps maximum).

Similarly, these criteria provide a level of stability such that the equipment will not be inherently unstable while resting on typical loading/unloading ramps (maximum angle with the horizontal of 14-15 degrees).

Stability requirements are summarized in Table 1.

3 STABILITY REQUIREMENTS - FREE STANDING PRODUCTS

Stability requirements set forth in this subhead apply to all free- standing Digital products regardless of intended shipping methods, equipment, or installation procedures.

Products offering identical multiples of major options in a cabinet (for example, a 1, 2, or 3 disk drive configuration) must verify and document stability performance according to this subhead for at least the maximum and minimum configurations (in this case, the 1-disk and 3-disk drive configurations).

The test item must incorporate all subassemblies, panels, doors, etc., but must not include any shipping materials or apparatus, nor any removable stabilizing devices used or activated only during maintenance or servicing.

Cabinet leveling feet used to raise cabinets off casters and to level the cabinets at the installation site may be installed. However, they must be adjusted to their innermost position, fully retracted into the cabinet base.

The following requirements for free-standing products are intended to ensure inherent product stability needed for safety during normal, manual movement of the product on its casters.

NOTE

An individual product or cabinet that does not incorporate casters or similar devices to facilitate movement may warrant a permanent waiver from the requirements stated under subhead 3 of this standard.

3.1 STABILITY IN DIRECTION OF TRAVEL

Each product must not tip over when tilted 20 degrees from its normal, upright, free-standing position in any direction of travel. This requirement takes into consideration that equipment stability may be affected by fixed or locked casters (subhead 2.1) and by minor irregularities while moving (subhead 2.2).

If all casters on the equipment are permitted to swivel, this criterion applies to the four nominal directions of travel (front, back, left, and right). If the equipment incorporates two fixed or locked casters (preventing swivel), then this criterion applies to the resulting two nominal directions of travel (for example, left and right).

Static stability criteria were based on dynamic stability requirements. Refer to subhead 2.2.

3.2 STABILITY IN ANY OTHER DIRECTION

Each product must not tip over when tilted 15 degrees from its normal, upright, free-standing position in any direction in which travel is prevented by fixed or locked casters.

3.3 NON-COMPLIANT PRODUCTS

Any product that fails to exhibit the stated stability must be physically improved so that it does meet these stability requirements before it is acceptable for production release or delivery.

Warning labels are unacceptable alternatives to the stability requirements for free-standing products. This is because such labels would have to be permanently and prominently visible externally on the installed product so as to warn about subsequent movement.

4 STABILITY REQUIREMENTS - PRODUCT AS SHIPPED

The following stability requirements are for the product as it is intended/specified to be shipped, whether skidded (subhead 4.1) or unskidded (subhead 4.2).

Assessment of the product will be based on all items that make up the product and all shipping materials/apparatus that contribute to the as-shipped state. In case of uncertainty (side panels, crating, etc.), the most disadvantageous assumptions will be made. It is not always necessary to have certain items (such as the crate, wraparound, etc.) physically present during measurements because accurate and repeatable effects may be known. However, in all cases, the stability assessment will clearly identify the product configuration and actual measured data. It will also identify analytical adjustments made to compensate for any missing items.

Marginal or deficient products should be re-verified by testing a complete physical configuration that requires no analytical adjustment.

4.1 PRODUCTS SHIPPED/HANDLED WITHOUT SHIPPING SKIDS

4.1.1 Stability in Direction of Travel

Each product must not tip over when tilted 20 degrees from its normal, upright, free-standing position in any direction of travel not restricted by fixed or locked casters (subhead 2.1). This requirement accounts for dynamic effects caused by minor surface irregularities during normal manual movement (subhead 2.2).

4.1.1.1 Acceptable Waiver Alternative

A product that is stable between 15 and 20 degrees off vertical in the directions of travel may be shipped if an appropriate stability warning label is specified and displayed prominently on the product and its packaging during shipping and handling. (Example: International top-heavy symbol and written instability warning in required languages.)

4.1.2 Stability in Any Other Direction

Each product must not tip over when tilted 15 degrees from its normal, upright, free-standing position in any direction in which travel is prevented by fixed or locked casters.

4.1.2.1 Acceptable Waiver Alternative

A product that is stable between 10 and 15 degrees off vertical in any direction in which travel is prevented by fixed or locked casters may be shipped. However, an appropriate stability warning label must be specified and displayed prominently on the product and its packaging during shipping and handling. (Example: International top-heavy symbol and written instability warning in required languages.)

4.1.3 Non-Compliant Products

Any product that fails to exhibit the stated stability or the waiverable alternative must be physically improved so that it does meet stability requirements before it is acceptable for production release or delivery.

4.2 PRODUCTS SHIPPED/HANDLED WITH SHIPPING SKIDS

4.2.1 Stability in Each Direction

Any product for which skidded shipping/handling is intended and specified must be skidded before it is stability tested. It is imperative that the skid used for shipping and testing incorporate bottom deck boards in the lowermost skid surface, beneath the area that material handling equipment forks/tongues will engage. After the product is so skidded, it must not tip over when tilted 15 degrees from its normal, upright, free-standing position in any of the four nominal directions (front, back, left, and right).

4.2.1.1 Acceptable Waiver Alternative

A skidded product that is stable when tipped between 10 and 15 degrees from its normal, upright position in any of the four nominal directions may be shipped. However, an appropriate stability warning label must be specified and displayed prominently on the product and its packaging during shipping and handling. (Example: International top-heavy symbol and written instability warning in required languages.)

4.2.2 Non-Compliant Products

Any product configuration that fails to exhibit the stated stability or the waiverable alternative must be physically improved so that it does meet stability requirements before it is acceptable for production release or delivery.

5 MEASUREMENT OF STABILITY

There are two ways to ensure that the product has the minimum inherent static stability required by this standard. One is to measure the actual stability angle (subhead 5.1), and the other is to perform a go/no go stability assessment (subhead 5.2). Either method is acceptable.

As stated in subhead 2.2, the stability requirements of this standard address the normally expected occurances in shipping and handling, and include dynamic effects on stability caused by minor surface irregularities during movement.

5.1 MEASUREMENT OF STATIC STABILITY ANGLE

Tip over angles cited previously and in Table 1 are the minimum static stability angles permitted for Digital products. These criteria can be verified by a balance method of measurement. The product is physically tilted in the required direction until it is balanced. The angle of tilt, measured from vertical, is the static stability angle. This angle can be measured directly with a machinist's protractor. Accuracy using the protractor can be assumed to be within ± 1 degree.

NOTE

Some products will be too heavy to be tested by hand, even with two or three individuals. Safety requires that these heavier products be manipulated using a hoist, handling slings, and locked caster wheels.

5.2 GO/NO GO STABILITY ASSESSMENT

Static stability angle criteria may also be met simply by tilting the product to the minimum required angle, gradually releasing it, and verifying that it returns to the vertical rather than tipping over. The minimum required angle can be determined using a machinist's protractor or by tilting the product against a template or frame that incorporates the required angle. When using the template or frame method, a product fails the safety criterion if it rests against the template or frame, rather than returning to vertical.

NOTE

Some products will be too heavy to be tested by hand, even with two or three individuals. Safety requires that these heavier products be manipulated using a hoist, handling slings, and locked caster wheels.

Table 1: Physical Stability Requirements

		Stability Requirement	Acceptable Alternative
Free Standing Product (Refer to Subhead)			
Direction of Travel	(3.1)	20°	None
Any Other Direction	(3.2)	15°	None
Products As Shipped			
Without Skids			
Direction of Travel	(4.1.1)	20°	15° - 20° with Warning Label (4.1.1.1)
Any Other Direction	(4.1.2)	15°	10° - 15° with Warning Label (4.1.2.1)
With Skids *			
Any Direction	(4.2.1)	15°	10° - 15° with Warning Label (4.2.1.1)

* Bottom deck boards required

APPENDIX A

REFERENCED DOCUMENTS

A.1 EL-Class Digital Documents

EL-Class Number	Document Title
EL-00119-01	*DEC STD 119-1 Digital Product Safety - Design Criteria*

Use VTX SMC to order copies of this document from Standards and Methods Control. Send distribution questions to JOKUR::SMC or call DTN: 234-4423.

```
+---------------------------------------------------------------------+
|                          READER COMMENTS                            |
|                                                                     |
| Your  comments  and suggestions  will help  Standards and Methods   |
| Control improve their services and documents.                       |
+---------------------------------------------------------------------+
```

Did you request this document? _____ If so, did it arrive within a satisfactory period of time? _____ Please comment.

What are your impressions of this document? Consider format, organization, completeness, readability, and illustrations.

————————————————**FOLD ON THIS LINE**————————————————

Did you find technical or clerical errors in this document? If so, please specify the page number(s) and the error(s).

Are the instructions for the update package clear? _____
Was an index available? _____ If not, is one needed? _____
Do you have other suggestions for improving this document?

The following information is optional:

Name _____ Mailstop _____

Department _____ Node _____

Send your comments to JOKUR::PROJECTS, or fold, staple, and send this page through interoffice mail to:

```
+-------------------------------+
|       READERS' COMMENTS       |
| STANDARDS AND METHODS CONTROL |
|           NRO4/D4             |
+-------------------------------+
```